UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/509,177	09/27/2004	Akinori Koukitsu	121213	5228

25944 7590 03/07/2008

OLIFF & BERRIDGE, PLC
P.O. BOX 320850
ALEXANDRIA, VA 22320-4850

EXAMINER	
SONG, MATTHEW J	
ART UNIT	PAPER NUMBER
1792	
MAIL DATE	DELIVERY MODE
03/07/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/509,177	KOUKITSU ET AL.	
	Examiner	Art Unit	
	MATTHEW J. SONG	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 December 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,12,13 and 18-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,12,13 and 18-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/10/2007*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/18/2007 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1-6, 12, 13, and 18-22 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. Claim 1 recites reacting a solid al with a halogenated hydrogen at a temperature of 700°C or below to produce a halogenated product of Al, however a minimal temperature is critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). A minimal temperature is required because the reaction of HCl to produce a halogenated product cannot take place at absolute zero, however the range of 700°C or below would encompass temperatures as low as absolute zero. Applicant discloses using temperature in

the range of 300-700°C on page 14, lines 1-2 of the specification. Claims 2-6, 12, 13, and 18-22 either depend from claim 1 or recite a similar limitation; therefore the same arguments apply.

4. Claims 1-6, 12, 13, and 18-22 rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a temperature range of 300-700°C the specification does not reasonably provide enablement for 700°C or below. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to produce a halogenated product of Al at absolute zero which is within the claimed temperature range, the invention commensurate in scope with these claims. A minimal temperature is required because the reaction of HCl to produce a halogenated product cannot take place at absolute zero, however the range of 700°C or below would encompass temperatures as low as absolute zero. Applicant discloses using temperature in the range of 300-700°C on page 14, lines 1-2 of the specification. Claims 2-6, 12, 13, and 18-22 either depend from claim 1 or recite a similar limitation; therefore the same arguments apply.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various

claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1, 3 and 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nikolaev et al (US 6,218,269) in view of Benander et al (US 4,698,244).

In a method of forming III-V compounds, note entire reference, Nikolaev et al teaches reacting Al metal with HCl at a temperature of 350-800 °C, this clearly suggests applicant's solid Al because Al metal is solid at temperature below 660 °C, to produce a halogenated product of Al, aluminum trichloride (col 7, ln 50 to col 8, ln 20). Overlapping ranges are held to be prima facie obvious (MPEP 2144.05). Nikolaev et al also teaches forming a III-V compound by reacting aluminum trichloride with ammonia to from AlGaN (col 8, ln 1-25). Nikolaev et al teaches a quartz reactor. (col 7, ln 50-65). Nikolaev et al also teaches Al reacting with HCl in a source zone and aluminum trichloride reacting with ammonia in the growth zone, this clearly suggests a first reaction in a first zone and a second reaction in a second zone.

Nikolaev et al teaches reacting Al metal with HCl at a temperature of 350-800 °C, this clearly suggests applicant's solid Al because Al metal is solid at temperature below 660 °C, to produce a halogenated product of Al, aluminum trichloride (col 7, ln 50 to col 8, ln 20). Overlapping ranges are held to be prima facie obvious (MPEP 2144.05). Furthermore, Benander et al teaches forming aluminum trichloride by reacting aluminum metal with HCl at a

temperature of 500°C. (col 5, ln 65 to col 6, ln 15 and col 3, ln 20-30). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Nikolaev et al by using a temperature of 500°C, as taught by Benander et al, because 500°C is known in the art to be a sufficient temperature to produce aluminum trichloride.

Referring to claim 3, Nikolaev et al teaches HCl.

Referring to claim 18, Nikolaev et al teaches reacting with ammonia.

Referring to claim 19, Nikolaev et al teaches a temperature of 800-1200°C (col 8, ln 1-20), which is completely within the claimed range. Nikolaev et al also teaches growth at 1100°C. (col 10, ln 1-65).

7. Claims 4, 6 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nikolaev et al (US 6,218,269) in view of Benander et al (US 4,698,244) as applied to claims 1 and 3 above, and further in view of Shibata et al (EP 184488 A2) and Vaudo et al (US 6,533,874).

The combination of Nikolaev et al and Benander et al teaches all of the limitations of claim 4, as discussed previously, except at least one of the amount of the halogenated hydrogen used; the amount of a carrier gas for the halogenated hydrogen; and the amount of the group V element containing gas is varied to deposit a III-V group compound semiconductors having different composition. The combination of Nikolaev et al and Benander et al teaches AlGaN layers forming pn junctions may have different AlN concentrations for different layers (col 7, ln 10-45).

In a method of HVPE, note entire reference, Shibata et al teaches HCl is introduced with H_2 carrier gas and reacted with metallic aluminum to form AlCl gas ([0034]).

It would have been obvious to a person of ordinary skill in the art at the time invention the combination of Nikolaev et al and Benander et al by using a carrier gas for HCl, as taught by Shibata et al, because carrier gases are known in the art to provide a smooth of reaction gases into the deposition chamber, as evidenced by Kang et al (US 6,197,683) in column 6, lines 15-25.

The combination of Nikolaev et al, Benander et al and Shibata et al does not teach the amount of a carrier gas for the halogenated hydrogen is varied to deposit a III-V group compound semiconductors having different composition.

In a method of HVPE, note entire reference, Vaudo et al teaches the composition of (Ga,Al,In)N is controlled by the flow of HCl over each metal as well as by the substrate temperature and by the temperature of each metal (col 11, ln 10-60), this clearly suggests varying the amount and the amount of carrier gas for the halogenated hydrogen gas because the flow of HCl is dependant on the flow carrier gas.

It would have been obvious to a person of ordinary skill in the art at the time invention to modify the combination of Nikolaev et al, Benander et al and Shibata et al by varying the HCl amount or amount of carrier gas, as suggested by Vaudo et al, to produce useful graded layers or pn junctions.

Referring to claim 6, the combination of Nikolaev et al, Benander et al, Shibata et al, and Vaudo et al teach HCl and H_2 ('488 Fig 4).

Referring to claim 21, the combination of Nikolaev et al, Benander et al, Shibata et al, and Vaudo et al teaches a temperature of 800-1200°C ('269 col 8, ln 1-20), which is completely within the claimed range. Nikolaev et al also teaches growth at 1100°C. ('269 col 10, ln 1-65).

8. Claims 2, 12 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nikolaev et al (US 6,218,269) in view of Benander et al (US 4,698,244) as applied to claims 1 and 3 above, and further in view of Solomon et al (WO 00/68470 A1) from IDS.

The combination of Nikolaev et al and Benander et al teaches all of the limitations of claim 2, as discussed previously, except reacting a solid mixture of group III metals including Al.

In a HVPE method, note entire reference, Solomon et al teaches reacting a group III metal with HCl, where the Group III metal is Ga, In, or Al or alloys thereof (pg 11, ln 1-25).

It would have been obvious to a person of ordinary skill in the art at the time invention to modify the combination of Nikolaev et al and Benander et al by using a mixture of Group III metals, which include Al, as taught by Solomon et al because a combination of known material suitable of its intended purpose is held to be obvious (MPEP 2144.07) and because an alloy of Group III metals can produce a ternary compound with a single source.

Referring to claim 12, Nikolaev et al teaches HCl.

Referring to claim 20, Nikolaev et al teaches a temperature of 800-1200°C ('269 col 8, ln 1-20), which is completely within the claimed range. Nikolaev et al also teaches growth at 1100°C. ('269 col 10, ln 1-65).

9. Claims 5, 13 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nikolaev et al (US 6,218,269), Benander et al (US 4,698,244) and Solomon et al (WO 00/68470 A1) from IDS, as applied to claims 2 and 12 above, and further in view of Shibata et al (EP 184488 A2) from IDS and Vaudo et al (US 6,533,874).

The combination of Nikolaev et al, Benander et al and Solomon et al teaches all of the limitations of claim 5, as discussed previously, except at least one of the amount of the halogenated hydrogen used; the amount of a carrier gas for the halogenated hydrogen; and the amount of the group V element containing gas is varied to deposit a III-V group compound semiconductors having different composition. Nikolaev et al teaches AlGaN layers forming pn junctions may have different AlN concentrations for different layers (col 7, ln 10-45).

In a method of HVPE, note entire reference, Shibata et al teaches HCl is introduced with H_2 carrier gas and reacted with metallic aluminum to form AlCl gas ([0034]).

It would have been obvious to a person of ordinary skill in the art at the time invention to modify the combination of Nikolaev et al, Benander et al and Solomon et al by using a carrier gas for HCl, as taught by Shibata et al, because carrier gases are known in the art to provide a smooth of reaction gases into the deposition chamber, as evidenced by Kang et al (US 6,197,683) in column 6, lines 15-25.

The combination of Nikolaev et al, Benander et al, Solomon et al and Shibata et al does not teach the amount of a carrier gas for the halogenated hydrogen is varied to deposit a III-V group compound semiconductors having different composition.

In a method of HVPE, note entire reference, Vaudo et al teaches the composition of (Ga,Al,In)N is controlled by the flow of HCl over each metal as well as by the substrate

temperature and by the temperature of each metal (col 11, ln 10-60), this clearly suggests varying the amount and the amount of carrier gas for the halogenated hydrogen gas because the flow of HCl is dependant on the flow carrier gas.

It would have been obvious to a person of ordinary skill in the art at the time invention to modify the combination of Nikolaev et al, Benander et al, Solomon et al and Shibata et al by varying the HCl amount or amount of carrier gas, as suggested by Vaudo et al, to produce useful graded layers or pn junctions.

Referring to claim 13, the combination of Nikolaev et al, Benander et al, Solomon et al, Shibata et al, and Vaudo et al teach HCl and H_2 ('488 Fig 4).

Referring to claim 22, Nikolaev et al teaches a temperature of 800-1200°C ('269 col 8, ln 1-20), which is completely within the claimed range. Nikolaev et al also teaches growth at 1100°C. ('269 col 10, ln 1-65).

Response to Arguments

10. Applicant's arguments with respect to claims 1-6, 12, 13, and 18-22 have been considered but are moot in view of the new ground(s) of rejection.

11. Applicant's arguments filed 12/18/2007 have been fully considered but they are not persuasive.

The declaration under 37 CFR 1.132 filed 8/16/2007 is insufficient to overcome the rejection of claims 1-6, 12, 13, and 18-22 based upon 35 U.S.C. 103 rejection in view of Nikolaev et al (US 6,218,269) as set forth in the last Office action because: the declaration fails

to show unexpected results in comparison with the closest prior art, Nikolaev et al (US 6,218,269). First, the declaration merely compares 650°C and 850°C. However, the highest temperature suggested by Nikolaev et al is only 800°C. Second, the declaration alleges unexpected results for 700°C or below, however no results for 700°C are present which shows the criticality of 700°C. There is only data for 650°C and 850°C; therefore the declaration is not commensurate in scope with the claimed invention. Finally, the Benander et al (US 4,698,244) has been added to show that 500°C is known in the art for reacting aluminum metal with HCl to produce aluminum trichloride.

Applicant's argument that Nikolaev et al does not teach reacting solid Al with a halogenated hydrogen at a temperature of 700°C or below to produce a halogenated product of Al in a quartz reactor is noted but not found persuasive. First, Nikolaev et al teaches Aluminum at a temperature of 350-800°C in a quartz reactor (col 7, ln 50 to col 8, ln 15), which overlaps the claimed temperature range; therefore is prima facie obvious since overlapping ranges are prima facie obvious. (MPEP 2144.05). Second, Benander et al (US 4,698,244) has been added to the rejection as further evidenced that production of aluminum trichloride by reacting aluminum with HCl at 500°C is known in the art. The use of temperature of 700°C or below is clearly taught by the prior art.

Applicant's arguments regarding the declaration filed 8/16/2007 are noted but not found persuasive. The declaration is not persuasive for the reasons discussed previously; therefore the arguments directed the declaration are not persuasive.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW J. SONG whose telephone number is (571)272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Barr can be reached on 571-272-1414. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew J Song
Examiner
Art Unit 1792

MJS
February 28, 2008

/Robert M Kunemund/
Primary Examiner, Art Unit 1792